

Assemblage thinking and actor-network theory

Muller, Martin; Schurr, Carolin

DOI:

[10.1111/tran.12117](https://doi.org/10.1111/tran.12117)

License:

Creative Commons: Attribution-NonCommercial-NoDerivs (CC BY-NC-ND)

Document Version

Publisher's PDF, also known as Version of record

Citation for published version (Harvard):

Muller, M & Schurr, C 2016, 'Assemblage thinking and actor-network theory: conjunctions, disjunctions, cross-fertilisations', *Transactions of the Institute of British Geographers*, vol. 41, no. 3, pp. 217-229.
<https://doi.org/10.1111/tran.12117>

[Link to publication on Research at Birmingham portal](#)

Publisher Rights Statement:

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

General rights

Unless a licence is specified above, all rights (including copyright and moral rights) in this document are retained by the authors and/or the copyright holders. The express permission of the copyright holder must be obtained for any use of this material other than for purposes permitted by law.

- Users may freely distribute the URL that is used to identify this publication.
- Users may download and/or print one copy of the publication from the University of Birmingham research portal for the purpose of private study or non-commercial research.
- User may use extracts from the document in line with the concept of 'fair dealing' under the Copyright, Designs and Patents Act 1988 (?)
- Users may not further distribute the material nor use it for the purposes of commercial gain.

Where a licence is displayed above, please note the terms and conditions of the licence govern your use of this document.

When citing, please reference the published version.

Take down policy

While the University of Birmingham exercises care and attention in making items available there are rare occasions when an item has been uploaded in error or has been deemed to be commercially or otherwise sensitive.

If you believe that this is the case for this document, please contact UBIRA@lists.bham.ac.uk providing details and we will remove access to the work immediately and investigate.

Assemblage thinking and actor-network theory: conjunctions, disjunctions, cross-fertilisations

Martin Müller^{1,2} and Carolin Schurr³

This paper shows that assemblage thinking and actor-network theory (ANT) have much more to gain from each other than debate has so far conceded. Exploring the conjunctions and disjunctions between the two approaches, it proposes three cross-fertilisations that have implications for understanding three key processes in our socio-material world: stabilisation, change and affect. First, the conceptual vocabulary of ANT can enrich assemblage thinking with an explicitly spatial account of the ways in which assemblages are drawn together, reach across space and are stabilised. Second, each approach is better attuned to conceptualising a particular kind of change in socio-material relations: ANT describes change without rupture, or fluidity, whereas assemblage thinking describes change with rupture, or events. Third and last, assemblage thinking could fashion ANT with a greater sensitivity for the productive role of affect in bringing socio-material relations into being through the production of desire/wish (*désir*). We demonstrate the implications of these cross-fertilisations for empirical work through a case study of the global market for assisted reproduction.

Key words assemblage; actor-network theory (ANT); desire; affect; Latour; Deleuze

¹Geographisches Institut, Universität Zürich, 8057 Zürich, Switzerland

Email: martin@martin-muller.net

²School of Geography, Earth and Environmental Sciences, University of Birmingham, Birmingham, B15 2TT

³School of Humanities and Social Sciences, Universität St. Gallen, 9000 St Gallen, Switzerland

Revised manuscript received 28 December 2015

Introduction

Assemblage thinking and actor-network theory (ANT) are among the most popular conceptual approaches in human geography today. Their concern with the more-than-representational and more-than-human aspects of the socio-material world forms part of a response to the perceived excessive focus on representations and meaning that emerged in human geography in the late 1980s with the turn towards poststructuralism. Authors across all geographical sub-disciplines have turned towards assemblages and actor-networks, whether in cultural geography (Thrift 2008), urban geography (McFarlane 2011b; Smith 2003), economic geography (Barnes 2002), political geography (Barry 2013; Dittmer 2014), feminist geography (Knopp 2004; Puar 2005) or environmental geography (Lorimer 2015; Whatmore 2002). The work of Gilles Deleuze and Félix Guattari, whose names are most often associated with the concept of the assemblage, and Bruno Latour, who has pioneered the actor-network, and their collaborators has made tremendous conceptual inroads into human geography. This can be gauged by the explosion of papers that carry 'assemblage' in the title or abstract, by the multiple and growing citations to

surveys of the approaches in geography (e.g. Anderson and McFarlane 2011 for assemblage; Murdoch 1998 for ANT) and by the critiques they have inspired (e.g. Castree 2002; Thien 2005; Tolia-Kelly 2006). Almost everything today is 'assembled' – made up of precarious socio-material relations.

The similarities between assemblage thinking and ANT are striking. Both have a relational view of the world, in which action results from linking together initially disparate elements. Both emphasise emergence, where the whole is more than the sum of its parts. Both have a topological view of space, in which distance is a function of the intensity of a relation. And both underscore the importance of the socio-material, i.e. that the world is made up of associations of human and non-human elements.

Despite these similarities, there are widely differing views whether the two approaches are compatible. John Law, one of the pioneers of ANT, sees them as almost the same: 'there is little difference between Deleuze's *agencement* (awkwardly translated as "assemblage" in English) and the term "actor-network"' (Law 2009, 147). The philosopher Graham Harman, by contrast, claims that Deleuze and Latour pursue irreconcilable projects:

The information, practices and views in this article are those of the author(s) and do not necessarily reflect the opinion of the Royal Geographical Society (with IBG). ISSN 0020-2754 Citation: 2016 doi: 10.1111/tran.12117

© 2016 The Authors. *Transactions of the Institute of British Geographers* published by John Wiley & Sons Ltd on behalf of Royal Geographical Society (with The Institute of British Geographers).

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

this lack of interest in flux and flow apart from specific entities separates Latour from such figures as Bergson and Deleuze ... Latour is, in fact, the Anti-Bergson [and thus the Anti-Deleuze]. (Harman 2009, 30)

Against these ambiguous views on the relationship between assemblage thinking and ANT, this paper explores the conjunctions and disjunctions between the two approaches – and the fertile space in between – with regard to three key dimensions of the socio-material world: stabilisation, change and affect. It takes stock of how geographers and others have used assemblage thinking and ANT and shows that the two approaches have much more to say to each other and gain from each other than the geographical discussion has hitherto conceded.

In so doing, this paper fulfils three important functions for geographers at large and other social scientists, not just for those already working with assemblage thinking or ANT. First, taking a comparative view, it gives a better sense of the conceptual resources available to understand processes of stabilisation, change and affect in two of the most-discussed approaches in contemporary human geography. These resources, but also their limits, are important when making a choice of theoretical frameworks for empirical research. Second, moving beyond conceptual considerations, the paper shows what difference ANT and assemblage thinking make when used in empirical work. Third and last, the paper argues for a careful synthesis rather than an indiscriminate mixing. Neither ‘almost the same’, as Law claims, nor ‘irreconcilable opposites’, as Harman thinks, assemblage thinking and ANT can engage in cross-fertilisations in some ways and directions more than in others.

To initiate these cross-fertilisations, the paper starts by mapping out the intellectual projects of assemblage thinking and ANT and the ways in which geographers and others have thought of their relationship. It then attempts to tease out the affinities and differences between the two approaches, suggesting three cross-fertilisations. For the first cross-fertilisation, the paper argues that ANT can provide the notion of the assemblage with an explicitly spatial account of how relations in an assemblage are drawn together and stabilised. For the second cross-fertilisation, the paper shows that the common ground between the two approaches has increased with ANT’s turn towards embracing multiplicities and fluidities in the 1990s. For the third and last cross-fertilisation, we suggest that ANT would benefit from the attention to the role of affect and desire in bringing socio-material relations into being, which is so central in assemblage thinking.

While this paper’s main contribution is theoretical, we also want to demonstrate that there is an empirical utility to these three cross-fertilisations. We do so with the help of the second author’s research on the

emerging global market for assisted reproduction.¹ Assisted reproduction refers to procedures such as in-vitro fertilisation (IVF), sperm and egg donation, and surrogate motherhood that intervene in human procreation and have experienced a massive growth in the past decades (Schurr and Fredrich 2015; Spar 2006). Assisted reproduction serves our purpose of illustrating the potential of a closer dialogue between ANT and assemblage thinking well. For one thing, it highlights the heterogeneous mixture of human and machine, of genes, sperms, calculation techniques and medical technologies that gives rise to new life (Franklin 2013; Parry 2015). Thompson has coined the term ‘ontological choreography’ to refer to the ‘dynamic coordination of the technical, scientific, kinship, gender, emotional, legal, political and financial aspects of fertility clinics’ (2005, 8). For another, the three processes that are at the heart of our three cross-fertilisations are equally central for the global market of assisted reproduction. First, the stabilisation of relations across distance; second, the need to deal with change and unforeseen events; and third, the central role desire plays in binding elements into the network.

Assemblages and actor-networks: the same, opposites or what?

Starting from the mid-1990s, ANT has had a sustained impact in geography. ANT sees agency as a distributed achievement, emerging from associations between human and non-human entities (the actor-network). Tracing the processes by which these associations are built, maintained and severed is at the heart of ANT. Geographers plumbed the concept for its usefulness for understanding acting at a distance and the ways in which networks work on space (Allen 2004; Murdoch 1998) and for razing the nature/society dualism and developing a more acute sense of how non-human materials or animals partake in shaping the world (Hinchliffe *et al.* 2005; Whatmore 2002). Its far-reaching implications for main concerns of geography – the notion of space and distance, the relationship of humans with technology and the environment, the exercise of power across distance – have no doubt contributed to ANT’s popularity across all subfields of geography.

Engagement with Deleuze and Guattari’s work also started in the mid-1990s and drew attention to their conceptualisations of flux, becoming and process (Bingham 1996; Doel 1996; Massumi 1996).² A deeper concern with ‘assemblage’ (*agencement* in the French original), however, appeared only 10–15 years later, when contributions started to speak of ‘assemblage geographies’ (Robbins and Marks 2010) and a special issue (Anderson and McFarlane 2011) and discussion forum (Anderson *et al.* 2012) were devoted to it. By that time, other disciplines, such as anthropology

(Marcus and Saka 2006; Ong and Collier 2005), had also picked up on the concept and Manuel DeLanda had presented his attempt of an 'assemblage theory' as a new theory of society (DeLanda 2006).

Assemblage as a concept is not straightforward to define, particularly because it is dense and intertextual, and something of a culmination of previous works, building on multiple lines of thinking Deleuze and Guattari had developed since the early 1970s in *Anti-Oedipus* (Deleuze and Guattari 1983 [1972]), *Kafka: toward a minor literature* (Deleuze and Guattari 1986 [1975]) and the treatise on the rhizome (Deleuze and Guattari 1976), a conceptual precursor to the assemblage. Deleuze once referred to assemblage as

a multiplicity which is made up of many heterogeneous terms and which establishes liaisons, relations between them across ages, sexes and reigns – different natures. Thus, the assemblage's only unity is that of co-functioning: it is a symbiosis, a 'sympathy'. It is never filiations which are important but alliances, alloys; these are not successions, lines of descent, but contagions, epidemics, the wind. (Deleuze and Parnet 1987, 69 [1977])

At their most basic, assemblages could thus be thought of as a collection of relations between heterogeneous entities to work together for some time. But they are more than this. Terms such as 'contagions', 'epidemics' and 'the wind' hint at the fluidity and ephemerality of assemblages and at their unpredictability, while 'sympathy' and 'symbiosis' suggest that there is a vital, affective quality to them.

From the aforementioned description, the conceptual affinities between the actor-network and the assemblage are patent (cf. Müller 2015; Murdoch 2006, 89–97). Latour (1999b, 15) hints at them when he compares the actor-network to the rhizome and endorses Deleuze and Guattari's 'very special brand of active and distributed materialism ... to which we [ANT scholars] have always referred' (2005, 129).³

It should not come as a surprise then that some scholars do not draw strict lines between the two concepts and draw on them almost interchangeably for the purposes of theorising a dynamic, lively socio-material world. Bennett (2010), for example, segues between Latour, Deleuze and Guattari, weaving together their conceptual vocabularies. In the introduction to a volume entitled 'Urban assemblages: how actor-network theory changes urban studies' (Fariás and Bender 2010), the editors anchor their contribution firmly in ANT literature but, as evident from the title, make 'assemblage' their concept of choice to describe those heterogeneous socio-material relations. For them, ANT is at heart Bergsonian and Deleuzian in its focus on qualitative multiplicities (Fariás and Bender 2010, 7). Within geography, accounts of lively, hybrid natures (Lorimer 2015; Whatmore 2002) are

perhaps best at shuttling between Latour and Deleuze, actor-networks and the assemblage. Others have used resources from both approaches but tend to be more sympathetic to either the actor-network (Allen 2003; Barry 2013) or the assemblage (McFarlane 2011a). Some have resorted to dialectical reading and used mediating concepts, such as the apparatus (Legg 2011).

Yet, it seems more common for geographers to stress the differences between the two approaches (e.g. Anderson *et al.* 2012, 178–9; Barry 2013, 183; Dewsbury 2011, 149–51). Thrift offers the best exposition of what, in his opinion, separates assemblage thinking and ANT:

Actor-network theory is good at describing certain intermediate kinds of effectivity, but [...] dies a little when confronted with the flash of the unexpected and the unrequited. Then, and I think this problem arises out of the first, actor-network theory still has only an attenuated notion of the event, of the fleeting contexts and predicaments which produce potential. [...] I think these two problems directly lead to a third one. [...] Actor-network theory has tended to neglect specifically human capacities of expression, powers of invention, of fabulation, which cannot be simply gainsaid, in favour of a kind of flattened cohabitation of all things. (2000, 214–15)

There are thus three shortcomings Thrift identifies in ANT: its failure to accommodate the unexpected, its lack of a notion of the event and the neglect of the corporeal capacities of humans – all of which have made Thrift turn to Deleuze, among other authors. Others have echoed these three major reservations and proposed the assemblage as a more suitable alternative, underscoring, for example, that the assemblage implies 'a greater conceptual openness to the unexpected' (McFarlane 2011b, 654) vis-à-vis ANT's preference for the fixed and stable, that 'Deleuze and Guattari are more "anticipatory" and concerned with continuing trajectories and future possibilities or becomings' (Bear 2013, 24).

In more conceptual terms, the most significant gulf between ANT and assemblage thinking is thought to be ANT's preoccupation with the actual vis-à-vis the preference for the virtual in assemblage thinking. ANT's preference for the actual is clearest in Latour's writings:

In ANT, it is not permitted to say: 'No one mentions it. I have no proof but I know there is some hidden actor at work here behind the scene.' This is conspiracy theory, not social theory. The presence of the social has to be demonstrated each time anew; it can never be simply postulated. (Latour 2005, 53)

The virtual, by contrast, is a central concept for Deleuze and can be thought of as 'the pressing crowd of incipencies and tendencies, ... a realm of *potential*' (Massumi 2002, 30; emphasis in original). While many

see in ANT a focus on the metaphysics of presence, on the properties of entities in an actor-network, and on constitutionalism (that entities are constituted by the relations that they are enrolled in), assemblage thinking belongs to a metaphysics of potentialities, which foregrounds the capacities of entities and relations of exteriority (e.g. Anderson *et al.* 2012). DeLanda (2006, 10) considers these relations of exteriority as the defining characteristic of assemblages. For him, this notion means that entities in relations are not fully determined by these relations, but always exhibit a surplus, something that is outside relations, and enables them to plug into other assemblages.

The concern of assemblage thinking with the, often aleatory, outside of relations manifests itself in a number of strands of geographical research. Work on anticipatory action – activities such as precaution, pre-emption and preparedness – emphasises how the very possibility of unpredictable events in the future shapes the form of networks in the present (Anderson 2010). Research on affect and atmospheres reflects the oscillation between absence and presence, materiality and immateriality and the fleeting character of situations (McCormack 2008; Militz and Schurr 2015). This work reflects a highly developed understanding of how the temporal frame of analysis makes a difference to the phenomena in question.

On the other hand, however, in many of the most cited uses, scholars have used ‘assemblage’ in ways that have very little to do with potentialities and capacities, but rather to denote those stable, coherent actualisations with very little apparent flux which proponents of the concept of assemblage attribute to ANT. DeLanda’s (2006) *A new philosophy of society*, for example, remains strongly wedded to discrete notions of scales (cf. Legg 2009, 238). What results – at the highest scale levels – is almost a structural account of urban development which refers to forces such as land rents, mobility, segregation and birth rates (stopping just short of mentioning capitalism) and subsumes central place theory (DeLanda 2006, 108) and classical geopolitics (113) under assemblage thinking along the way. Ong and Collier (2005), another important inspiration for geographers, also stress the actual rather than the virtual side of assemblages. They see assemblages as ‘global forms ... articulated in specific situations’ and as ‘territorialised’ (2005, 4) – what they call ‘the *actual* global’ (2005, 12; emphasis in the original). Li examines how – with the help of multiple social actors, statistical techniques and inscription devices – land is assembled as a resource for global investment (Li 2014). Again her attention falls more on the work of stabilising assemblages, the enrolling, aligning, smoothing, authorising and managing necessary to secure assemblages (Li 2007, 265).

The use of the assemblage to describe relatively stable forms of networked organisation echoes Ander-

son *et al.*’s concern that geographers use assemblage ‘simply to designate a new form of sociospatial organization in a way that drains this terminology of its dynamic potential’ (2012, 173). The focus on resultant *form* rather than emergent *formation* is not uncommon in geographical work that draws on the assemblage, for example where it emphasises ‘networked actors and materialities’ in ‘relations of various kinds’ (Harrison and Popke 2011, 950) or where ‘the concept of the assemblage directs attention to the relationships between elements and the work that is done to sustain those relationships and networks’ (Roberts 2014, 1031). Yes, these assemblages are seen as multi-scalar, heterogeneous and distributed, but at the same time they seem to return to the network metaphors that assemblage thinking sought to overcome in the first place (McFarlane 2009).

Cross-fertilisation I: stabilising relations (or what assemblage thinking can take from ANT)

When assemblage thinking is used to provide accounts of the stabilisation of relations, it faces one key shortcoming: its conceptual apparatus is under-equipped to deal with the multifarious ways of assembling at anything else than a very general and descriptive level. At worst, references to assemblage thinking risk providing a veneer of theoretical sophistication to otherwise descriptive accounts that risk becoming ‘a simple joining-up exercise’, resulting in ‘thin description’ (Allen 2011, 156) to which the assemblage moniker makes little difference.

That assemblage thinking provides few concepts for empirical work is not surprising; after all it is a philosophical perspective, not an empirical toolbox. In fact, Latour sees this as the main difference between him and Deleuze: Deleuze’s project is about metaphysics and philosophy, whereas his is about anthropology and philosophy and thus more empirically grounded (Latour in Iliadis 2013). For the empirical toolbox, then, we can usefully look to ANT. With its origin in Science and Technology Studies, empirical work is at the heart of ANT, to the degree that Law (2009, 141) insists that describing ANT in the abstract misses the point, because we can only understand the approach if we have a sense of the case studies through which it was developed and refined. ANT not only provides a rich selection of case studies, but it also has a repertoire of concepts through which to understand the work of stabilising relations, whether this is the distinction between intermediaries and mediators (Latour 2005), oligoptica as centres of limited power (Latour 2005), the intricate process of translation (Callon 1986) or the idea of the (im-)mutable mobile (Latour 1987).

There is a practical advantage to this rich conceptual toolbox of ANT: ANT has produced many studies in which those concepts are developed and applied, and which can serve as a useful guide for further empirical work. But perhaps more important is the analytical advantage: while ANT still *starts* from description, it *arrives* at explanation through description.

Whereas ANT presents an explicit spatial sensitivity where it refers to regions, scales, distance and topologies (e.g. de Laet and Mol 2000; Law and Mol 2001; Mol and Law 1994), in assemblage thinking spatiality remains rather implicit. Deleuze and Guattari's approach 'leaves much to be said about what brings people within reach', as Allen points out: 'if the topology is a bold one, the spatial configuration ... remains frustratingly abstract' (2003, 85). Assemblage approaches are thus often wanting where it would matter the most for geographers: in providing a better understanding of the relational achievement of bringing what is far away close and making the close-at-hand appear far away.

'You need to control the whole process': governing assisted reproduction at a distance

The precarious governance at a distance of assisted reproduction drives home the point of how an ANT toolbox is better attuned to describing both the mechanisms of stabilisation of a network and the spatialities of assembling. Transnational assisted reproduction would not exist today without organisations such as 'My Baby'. 'My Baby' is a surrogacy agency. Surrogacy agencies are a new type of organisation that came into being to solve, or at least to attempt to solve, a central problem of transnational assisted reproduction: to bring the diverse actants in the business of assisted reproduction together and make them cohere – long enough, at least, to produce a baby. It is the job of organisations such as 'My Baby' that Manuel and Rodrigo from Spain, who want a baby and have the money, meet the egg cell of Anita, an egg donor in Sweden; the womb of Benita, a young mother of two from Chiapas; and Dr José in Cancún, whose clinic is equipped with state-of-the-art medical technology from the USA. But not only do they need to meet, they need to meet at the right time, under the right circumstances.

'My Baby' conducts this intricate choreography across distance. Its head office is in the Republic of Georgia, where it was founded in 2008, and it then started to expand, first to other Eastern European countries and then later to India (2010), Thailand (2011), Mexico (2012), Nepal (2013) and Cambodia (2014). In each location, it offers some or all of its reproductive services to clients from around the world. 'My Baby' is a true multinational enterprise that governs one of the technologically, emotionally and ethically most challenging processes: the creation of new life.

But how does 'My Baby' manage to control this global enterprise? In Latour's terms, 'My Baby' would be an oligopticon: a centre of coordination with a 'sturdy but extremely narrow [view] of the (connected) whole' (Latour 2005, 181) – in this case the assisted reproduction business. It manages to govern at a distance by enrolling the necessary elements in relations and holding those relations stable for a while – and it does so with a little help from some friends. Here is how its CEO put it:

Trust is good, but you really need to control the whole process of a surrogacy journey from beginning to the end, because it is a complicated process. Even more when the parents live far away from their surrogate. Every country manager sends me a full report every week. How many clients have been contacted? How long have they talked? ... What were the questions? What is the stage of the [reproduction] process? Is the contract signed (or why is it not?)? Names of surrogates, donors, their status of preparing for the cycle, an evaluation if they are 'good' donors or surrogates, any trouble? You know all that kind of information, then a weekly financial report, incomes, expenditures, and the digital print of the finger print machine that controls the working hours of our employees. This is to make sure that they don't work from home whenever they feel like it, because, as most of the work is online, they easily could, but then you lose control. It is all in my laptop, every single report. (Interview CEO 'My Baby', 16 August 2013)

'My Baby' is a good example of how an oligoptic gaze is established across transnational space. Writing devices such as the weekly financial and management reports, the transcripts of the finger print control or thick manuals for new employees order the (inter-) actions between the head office in Georgia and the diverse country offices and render it asymmetrical at the same time, as 'all the writings are brought together in a single place' (Callon 2002, 207) – in this case the CEO's mobile computer. In other words, 'My Baby' relies on intermediaries to coordinate its far-flung networks; on devices supposed to 'transport meaning or force without transformation' (Latour 2005, 39).

Yet, some of the most important parts of the reproduction process escape its gaze. For while 'My Baby' may define requirements and processes on paper and manage the appointments of intended parents, egg donors and surrogates at the local clinic it works with, it has little control over what happens inside the operating theatre, how their clients, donors and surrogate mothers are treated, how results are communicated via skype or phone, especially when it is bad news about failed treatment cycles or an embryo that has not made it through the first couple of weeks.

You can't control customer service, success rates, the way they [the medical staff] treat the donors and surrogates, the protocols and drugs they use ... It is a very emotional field, very human, and it is very difficult anyway as the clients are

often far away in another country or even on another continent, so you need to have a connection, good customer service. (Interview country manager for Mexico, 'My Baby', 5 September 2014)

What were intended as intermediaries – faithful transmitters of the same procedures across the globe – had turned, in this case, into mediators: 'mediators transform, translate, distort, and modify the meaning or the elements they are supposed to carry' (Latour 2005, 39). The various mechanisms of control had failed to produce one and the same results, but rather introduced multiplicities in how courses of fertilisation were conducted. 'The tiniest bug can blind oligoptica', writes Latour (2005, 181).

'My Baby's' assisted reproduction actor-network is thus a fragile accomplishment, working as intended in some instances, but producing unexpected results in others. What an ANT-inspired description adds over and above an assemblage approach in this analysis of how stability is achieved is a more nuanced understanding of the mechanisms that make the elements of the network cohere but at the same time produce unexpected multiplicities. The enrolment of elements with the help of intermediaries, the restricted gaze of the oligopticon when intermediaries convert to mediators, are concepts that allow not just a fine-grained description of the labour involved in governing at a distance, but it offers an analytical vocabulary for the processes of stabilisation.

Cross-fertilisation II: change through fluidities and events (or common ground)

The previous sections have shown that many see in ANT's preference for the actual vis-à-vis assemblage thinking's focus on the virtual the main reason hampering further rapprochement between the two. This rift perceived between the two approaches results, however, from a doubly selective reading of ANT prevalent in geography. For one thing, it emerges from the early ANT literature of the 1980s and 1990s, which served as the key inspiration for geographers in the mid-1990s when ANT entered geography. As Latour admitted, this literature exhibited a 'managerial, engineering, Machiavellian, demiurgic character' (1999b, 16). Indeed, in their critiques of Latour and ANT as actualist, Harman (2009, 6, 101) confines himself to the Latour before 1999, as does Thrift (2000). ANT, however, made a major turn towards opening itself to more ephemeral forms of relations in the late 1990s. That time marks the publication of two important volumes: the edited book *Actor-network theory and after* (Law and Hassard 1999) and Latour and Hermant's (1998) *Paris: ville invisible*, perhaps the most important ANT work in moving towards the virtual, but not much read in geography.

For another thing, the reading of ANT is selective by focusing mostly on Latour. Among ANT protagonists, however, Latour is probably most strongly wedded to an actualist agenda. Other ANT writers, such as Law and Mol, had flirted with the virtual already at the beginning of the 1990s (Mol and Law 1994). The apparent gulf between ANT and Deleuze and Guattari's assemblage thinking thus results from restricting the reading of ANT, for the most part, to a pre-1999, Latourian ANT.

The post-1999, more-than-Latourian ANT is much closer to assemblage thinking in two respects. The first alignment is around the question of fluidities. Mol and Law (1994) offer fluids as an alternative metaphor to the network. In fluid spatiality, associations are incomplete and shifting, however without producing breaks and discontinuities. Entities may move in and out of the network, new relations may be forged and existing ones cut, but instead of disrupting the whole network, this just transforms the resultant actor. Mol (2002) uses the example of anaemia that assumes different forms whether it is diagnosed in the clinic or in the laboratory, but still remains anaemia.

One should not underestimate the radical nature of fluid spatiality for ANT. In ANT's early, Latourian version, 'actors are always so specifically deployed with various accidental qualities and outward-bound relations that they cannot survive changes in these qualities and relations' (Harman 2007, 30). Fluid spatiality, by contrast, suggests that the relations can change, often gradually, without the actor falling apart as a result; that they can 'transform themselves without creating difference' (Mol and Law 1994, 641). This moves ANT towards the blurred boundaries and shifting topologies that are so integral to assemblage thinking (DeLanda 2006; Deleuze and Guattari 1987).

The second alignment of a post-1999, more-than-Latourian ANT with assemblage thinking revolves around the virtual. ANT started off as an actualist approach: what could not be traced could not exist. For ANT there used to be no outside to relations. It was only with *Paris: ville invisible* (Latour and Hermant 1998) that Latour took up the issue of the outside of relations, in fact relying on Deleuze's term of the virtual (*le virtuel*), which Latour called 'plasma':

There is indeed power; that is, force, virtualities, empowerment, a dispersed plasma just waiting to take shape. The term Virtual Paris ... means a return to incarnation, to virtualities. (Latour and Hermant 2006, 103)

We can imagine the virtual in cities as the ever-present potential for breakdown and disruption in the complex, but invisible infrastructure systems that make city life possible in the first place (Graham 2010; Star 1999). Granted, Latour seems to embrace the virtual with some reluctance. He will not be remembered as the great

theorist of the virtual – but he concedes its existence and the necessity to engage with it. Again, Law is somewhat more daring in his theorising when writing that this new plasmatic perspective ‘assumes out-there-ness to be overwhelming, excessive, energetic, a set of undecided potentialities, and an ultimately undecidable flux’ (Law 2004, 144). He and Mol underscore that presence depends on absence or alterity, thus underscoring the important role of exteriority (Law and Mol 2001, 615–16). This takes us quite a bit down the road towards assemblage thinking and is certainly a long way from ANT’s actualist beginnings and a purely actualist reading of ANT as focusing on goal maximisation (Ong 2007) and rigid networks (Thrift 2000).

‘In the war, I learnt to prepare for disasters’: fluid and disrupted assisted reproduction

At first glance, it may seem that ‘My Baby’ has a rather immutable, standardised and uniform business system consisting of templates, contracts and manuals, circulated to its associates around the globe. But ‘My Baby’ could not exist without network fluidity. In fact, it is an integral part of its business strategy. The final outcome – the baby – needs to be held constant, but the associations that bring it about shift all the time. Remember the intermediaries turning into mediators from the previous section? What became important was not so much the exact replication of fertilisation procedures but arriving at the result, the baby. The actor was kept stable by keeping the network relations fluid. ‘My Baby’ achieves constancy by shifting its boundaries and internal structures incrementally: when new branches open, structures, contents and business strategies are not transported immutably but are transformed and translated through mediators such as country managers, local lawyers or new Facebook campaigns seeking surrogate mothers:

We are able to move into a new country in no time, because we have a system, the same system for every branch. We have the template for the homepage, the contract ready, our international travelling egg donor online bank, the manual for new employees ... But, doing business in different countries isn’t always easy ... In Mexico we had to raise the monthly pensions for the surrogates because costs of living are higher than in Eastern Europe or India. (Interview CEO My Baby, 16 August 2013)

So there is the oligopticon again, with its sturdy, narrow views, shifting shape as it moves from one context to the other. But what about the virtual, the unforeseen events? The virtual, in fact, intrudes at every instance in ‘My Baby’s’ business, given the unpredictability of the biological processes involved. A clinician explains it like this:

Assisted reproduction is a complex and fragile process. You work with biological cycles, so you have to make sure that

things happen in time. Otherwise you waste a lot of money and of course, clients, surrogates and donors get pissed off if you waste a cycle, because it means to wait another four weeks for the next attempt. (Interview with cycle manager, 10 August 2014)

Just about 20–50 per cent of cycles are in fact successful in the sense that they result in a live birth. Failure is thus the default option, underscoring that the assisted reproduction assemblage is a fragile arrangement always at the brink of falling apart.

Of course, clinicians have learned to adapt and anticipate to some of the unpredictability in the business of assisted reproduction. A Georgian IVF doctor recounts:

It’s very difficult for you to imagine me running and fighting in a war, but that was my life twenty years ago. This life experience of being in a war also helps in business because you are really trained to improvise. I am always prepared for problems. For example, in the clinic we have water heating by gas, by electricity, by solar and once, when it was winter and nothing worked, we even had firewood. In my backpack, I always have a [surgical] mask with me, so I can enter the lab in case of an emergency. I have different internet devices with me, USB and satellite, to make sure the system does not break down. In the war I learnt to prepare for disasters and it has helped me a lot in my IVF clinic to solve problems quickly. (Interview IVF doctor, Tbilisi, 8 August 2013)

The analogy between war and assisted reproduction is revealing. Wars are probably the most event-full situations in human lives, where the virtual unleashes all its force and unpredictability, turning existing orders upside down (cf. Deleuze and Guattari 1987, 229ff., on the war machine). Improvisation is one way of responding to events and the doctor’s preparedness shows how the virtual bears on the actual, how the potential future bears on what is present by necessitating precautions (cf. Anderson 2010). The doctor always carries a surgical mask with him and a backup internet connection – *just in case*. But often enough no degree of improvisation can save the assemblage. IVF cycles fail, the embryo does not successfully ‘nest’ into the surrogate’s uterus, surrogates might decide to clandestinely abort the foetus after receiving the first installment of their compensation because they have changed their mind.

For the analysis of change and disruption in ‘My Baby’s’ assisted reproduction assemblage, ANT and assemblage thinking can thus work in tandem. ANT has been more interested in fluidity – the changing of shape of networks without disruption – as it occurs in ‘My Baby’s’ international expansion. Assemblage thinking, on the other hand, is much more attuned to the absent presence of the virtual, the incipient possibilities inherent in any situation and how, by relations of exteriority, elements are never fully enrolled and determined by their networks. This reservoir of possi-

bilities is what makes assisted reproduction an often unpredictable, almost aleatory undertaking that fails more often than not and disrupts even the seemingly most resilient networks.

Cross-fertilisation III: affect: desire/wish (or what ANT can take from assemblage thinking)

We have seen that on the issue of fluidities and the virtual, ANT is closer to Deleuze and Guattari's assemblage thinking than much previous scholarship would concede. But there remains at least one key difference: ANT stops short of conceptualising the capacities of bodies, both human and non-human, to affect and be affected. It is not that ANT is completely disinterested in the human body or that it would see humans merely as calculating, reflexive subjects, as some critics argue (e.g. Laurier and Philo 1999, 1063). Latour (1999a), in fact, has made efforts to conceptualise the emotions and passions of subjects through the notion of attachment. Gomart and Hennion (1999), for example, ask how a drug user becomes attached to drugs or a music lover to music. But this notion of attachment exhibits more than a touch of residual actualism, for it takes attachment to arise out of networks as a mediated effect (Latour 1999a, 31). The same is true for Latour's (2004) theorisation of the body – a body circumscribed by the relations that describe it and never exceeding them.

For Deleuze and Guattari, however, affect becomes together with the assemblage, not as a result of it. Desire plays a key role here, because it makes assemblages coalesce together: 'Desire constantly couples continuous flows and partial objects that are by nature fragmentary and fragmented' (Deleuze and Guattari 1983, 6). Desire is *désir* in the French original and the alternative translation as 'wish' removes the sexual connotation that is ever-present in the English translation. Desire/wish here is best understood as a positive, productive force – 'a spontaneous emergence that generates relationship through a synthesis of multiplicities' (Goodchild 1996, 4).

The central role of desire/wish for Deleuze and Guattari is reflected in the concept of the assemblage, which emerges from the earlier notion of 'desiring machines' (*machines désirantes*), advanced in *Anti-Oedipus* (Deleuze and Guattari 1983).

Assemblages are passionate, they are compositions of desire. ... The rationality, the efficiency, of an assemblage does not exist without the passions the assemblage brings into play, without the desires that constitute it as much as it constitutes them. (Deleuze and Guattari 1987, 399)

Assemblage is the expression of desire/wish: 'desire is one with a determined assemblage, a co-function'

(Deleuze 2006, 125). But desire/wish is not just a stabilising but also a destabilising force in an assemblage, a line of flight that takes an assemblage apart (Deleuze and Guattari 1986, 59).⁴

Deleuze and Guattari's notion of affect and desire/wish should form not just a welcome but indeed a necessary complement to ANT in three respects. First, it pushes ANT's dalliance with the virtual beyond the rather amorphous concept of plasma by considering how the virtual is connected to the processes of assembling and disassembling. Desire/wish can be read as an expression of the link between the actual and the virtual, where the virtual always bears on the actual but always exceeds it at the same time. Where ANT has recognised the necessity of the virtual in general terms, desire/wish in assemblage thinking works through its mechanisms and effects. Second, it allows addressing Thrift's critique of ANT, quoted above, that ANT has neglected 'specifically human capacities of expression' (2000, 215). Although Deleuze and Guattari see desire/wish as manifested in a distributed arrangement, it founders without humans and the human body. This move would also assuage the frequent apprehension that ANT treats humans and non-humans as completely symmetric and effaces any difference between the two (Castree 2002), without taking recourse to reinstituting the unified human actor. Third and last, embracing desire/wish would see ANT moving away from that 'deadpan sense of happenstance' (Collinge 2006, 250), where it is unclear what brings actor-networks into being, makes them cohere or pulls them apart. It would introduce a force that drives assembling, however without relying on larger structural forces. Analysing assemblages would then mean analysing the production of desire/wish.

'It always astonishes me what capacities this longing unfolds': desiring assisted reproduction

This desire [*deseo*] for a baby is so strong, it always astonishes me what capacities this longing unfolds, what the intended parents manage to move. They organise themselves, they ask friends and family for support, they do all this research to come here to a foreign country, they trust professionals like us and they emotionally support the surrogates throughout the process, so that the surrogate in the end is convinced that it was the right thing to do. (Interview IVF doctor, 21 January 2014)

Without us prompting him, the doctor in this interview used the word desire (*deseo*) to put in words the driving force behind assisted reproduction – a force that helps intended parents overcome the logistical, financial, ethical and emotional odds involved in travelling abroad, buying egg cells and hiring surrogate mothers. But one needs to be careful here not to

conflate his understanding of desire with Deleuze and Guattari's concept of desire/wish. For the doctor, desire seems to originate in two individuals – the intended parents – and be focused on one object – the baby.

In the desiring machine that is global assisted reproduction, many other elements, however, have a role to play and many other wishes are linked to the wish of having a baby. Desire/wish, for one thing, is distributed. It is produced as much by the heteronormative imperative of the 'happy family' that pervades most societies (Ahmed 2008) as it is by the pictures that agencies such as 'My Baby' and clinics use to visualise the 'little prince' as the crowning glory at the end of parents' travails (Figure 1). The use of the 'prince' metaphor is particularly telling, as it further idealises the (male) offspring underscoring his uniqueness and placing him in an imaginary royal lineage, son and heir to the throne and the kingdom. The desire/wish for profit is the key rationale for agencies and clinics to become enrolled in the assemblage. The desire/wish for wealth and a better life for themselves and their children enrol egg donors and surrogate mothers. And sometimes the desire/wish to help deprived surrogate mothers enrolls intended parents just as the desire/wish to help an infertile couple

sometimes enrolls surrogate mothers, overriding religious or ethical reservations.

These desires/wishes need to come together for the global assisted reproduction assemblage to emerge. Just one of them is not enough to sustain it. Desire/wish, in multiple forms, is the central force driving the emergence of the assisted reproduction assemblage and binding the human and non-human elements together: intended parents, egg donors, surrogates, IVF professionals, airplanes, time schedules, petri-dishes, hormonal drugs and so on. It becomes a positive and productive force that is 'able to form connections and enhance the power of bodies in their connection' (Ross 2005, 66). In so doing, the desire/wish to parent negates boundaries between nature and culture, when it biologises technology and technologises biology (Franklin 2013, 2–3). In other words, assisted reproduction models technologies after biological processes and makes biology, makes life, an object of technological interventions.

But desire/wish not just assembles; it also disassembles. Another surrogacy agency, 'Baby to go', for a while ran a fraud scheme in which it promised to deliver babies but never did. One thus deceived parent recounted:



Figure 1 'We help you to get this prince you desire so much'

Source: Insemer: Especialistas en Medicina Reproductiva (Mexico)

John [the CEO] was really good at promising us that next time, it [the embryo transfer] would work, that he would find another surrogate mother, that they are now using different drugs. He always had excuses and we kept on paying and paying. Until we got a call from another intended father who told us that the agency had gone bankrupt and that we won't get our baby. Neither our baby nor all the money we had spent so far. (Interview intended parent, 12 August 2014)

While 'Baby to go' managed to sustain the wish for a baby for a long time over distance (with the intended parents being located in the Bay Area, the surrogates in Mexico, the CEO in India), a new connection to another intended father let the network fall apart and its desiring production founder. Both parents moved to 'My Baby' that in the end kept its promise and delivered the baby into the arms of the two fathers. The different elements of the 'Baby to go' assemblage dispersed but then re-assembled, such as when the surrogate house hosting the surrogates for 'Baby to go' switched to host the surrogates for a Spanish agency. Desire/wish can thus become a destabilising force in assemblages: when desire/wish production breaks down, assemblages break up; when desire/wish production is stronger in another assemblage, elements may become enrolled there.

The stability of the global assisted reproduction assemblage is tied up with the ability of relations between (non-)human bodies located in different sites to produce desire/wish. Desire/wish does not emerge as a result of the assemblage, but emerges with and in the process of assembling. This makes desire/wish and assemblage co-constitutive. The contrast to ANT is striking here. For ANT, desire would result from the assemblage and bodies would learn to desire through the assemblage. But this would not explain how desire/wish is implicated in making the assemblage emerge and cohere. It would turn desire/wish into a passive consequence and afterthought rather than an active co-constituent of assemblages.

Conclusion

Geographers have either tended to consider ANT and assemblage thinking as almost the same or they have stressed the differences between them. Neither stance is particularly useful for geographical theorising, because they both preclude a sustained dialogue. Treating the two approaches as almost the same risks subsuming one approach under the other and glosses over key differences, whereas stressing the differences skirts over the commonalities of the two. Instead, we have proposed that ANT and assemblage thinking are neither identical twins nor distant cousins but rather, to stick with the familial leitmotif of the paper, close siblings. Close enough to speak to each other, yet different enough to learn from each other.

Exploring the conjunctions and disjunctions of ANT and assemblage thinking has allowed us to suggest three cross-fertilisations. First, ANT has a richer conceptual vocabulary for analysing the stabilisation of relations, which it can bring to assemblage thinking. Indeed, much empirical work that employs the notion of the assemblage is often about assembling in the sense of constructing something more or less durable. But stability is just one aspect of assemblages and it is perhaps the interplay of stability and fluidity that should interest us most. Thus, in our second cross-fertilisation, we show how ANT and assemblage thinking have recently edged closer to each other in the theorisation of flux, with a post-1999, more-than-Latourian ANT embracing notions of multiplicity and fluidity. Third and last, assemblage thinking could and indeed should bring to ANT a greater appreciation of the capacities of bodies to affect and be affected. It is the force of desire/wish (*désir*) that co-constitutes an assemblage and without which assemblages are unthinkable.

These three cross-fertilisations make the empirical project of understanding and engaging with socio-material relations – whether we call them actor-networks, assemblages or something else – different in three crucial respects. For one thing, they encourage to selectively and purposively draw on the conceptual vocabulary of ANT, which emerged from detailed field studies, to lend to assemblage-inspired accounts a more nuanced and, crucially, a more spatially sensitive understanding of the mechanisms through which *stability* comes about, why it persists and how it reaches across space. For another, they encourage greater differentiation about the *types of change* we encounter in socio-material relations. ANT is better attuned to fluidity, meaning change without rupture, whereas assemblage thinking shows a greater openness towards the aleatory and unpredictable, towards the event. Finally, these cross-fertilisations help to better appreciate the *affective dimension of socio-material relations*, seeing desire/wish not as an outcome of relations, as ANT would have it, but as emerging together with them. Analysing socio-material relations would thus mean placing a stronger focus on analysing the production and perpetuation of wishes.

For geographers engaged in empirical work, a cross-fertilisation between ANT and assemblage thinking offers, in a sense, the best of both worlds. Conjoining the two approaches allows making the strengths and sensitivities of each approach work for the other. It brings the tried-and-tested ANT toolbox of concepts to bear on empirical studies of the emergence of order and disorder in a more-than-human world. It sharpens our sense of different kinds of change in socio-material relations, whether fluidity or event. And it does so in a mode that is attentive to the distributed, bodily capacities of humans and non-humans alike. The price

we need to pay for this is a small one, we think. Above all, it involves leaving behind some cherished certainties as we abandon the safe territories of our conceptual homelands.

Acknowledgements

The audience at the AAG in Chicago in 2015 provided engaged comments on this paper. Three reviewers broadened our horizon and helped us reconsider parts of our argument – thank you for your time and generosity. Carolin is very grateful to all the people she talked to during her fieldwork in Mexico, in particular to the agency and its representatives that serve as a case study in this paper. Funding from the ‘Society in Science: The Branco Weiss Fellowship’ and a Swiss National Science Foundation Professorship (grant number PP00P1_144699) provided not only the financial means for conducting extensive fieldwork, but has also opened up the necessary intellectual space for free thinking. Louise Charlotte, *enfin*, pushed us to finish this paper just in time.

Notes

- 1 The paper draws on ethnographic research on assisted reproduction conducted from August 2013 until April 2015 (a total of eight months in six stays). The research included observation of everyday work and lives in fertility clinics, surrogacy agencies and surrogate housing in Tbilisi (Georgia), Guatemala City (Guatemala), Mexico City, Cancún, Villahermosa and Puerto Vallarta (all Mexico) as well as at conferences and exhibitions of assisted reproductive technologies and surrogacy in Mexico City, Munich, Madrid, Barcelona and London. About 100 interviews were conducted in these different places with physicians, biologists, nurses responsible for egg and sperm donors, agents of reproductive tourism, CEOs of surrogacy agencies, intended parents, surrogates and egg donors. All names of organisations and people have been anonymised.
- 2 This article restricts itself to the Deleuze-and-Guattari-inspired use of assemblage *as a concept* and to literature that cites them as the major inspiration. The focus on Deleuze and Guattari reflects the main sources of inspiration of assemblage thinking in geography and is not meant to derogate from the diversity of sources and understandings for ‘assemblage geographies’ (Robbins and Marks 2010), ranging from the use of assemblage as a descriptor and ethos to that as a concept (Anderson *et al.* 2012). This diversity, however, also comes with problems of its own where it results in vagueness or where assemblage is used as a descriptor in an indiscriminate fashion.
- 3 Deleuze’s work also had an effect on the initial formation of ANT, even though ANT authors hardly cite him. Hennion, a long-time collaborator of Callon and Latour at the Centre de Sociologie de l’Innovation (CSI) at the École des Mines, remarked in a recent interview: ‘Despite the strong influence that Deleuze had on our work compared with other authors, we rarely cited him in the

texts of the CSI’ (Hennion 2013, 29). Latour’s (1987) *Science in action* does not cite Deleuze a single time; his *Reassembling the social* (2005) mentions him twice in the footnotes and twice in the text.

- 4 In positing distributed agencies and the force of affect, Deleuze and Guattari’s thought exhibits more than just a little coalescence with feminist science studies – certainly more than ANT. The overlaps with Haraway’s (1991) work and its concern with the embodied and differently marked subject are considerable (see also Braidotti 2006) as is the interest in how ‘the very materiality [of the body] plays an active role in the workings of power’ (Barad 2007, 65).

References

- Ahmed S 2008 Sociable happiness *Emotion, Space and Society* 1 10–3
- Allen J 2003 *Lost geographies of power* Blackwell, Oxford
- Allen J 2004 The whereabouts of power: politics, government and space *Geografiska Annaler B* 86 19–32
- Allen J 2011 Powerful assemblages? *Area* 43 154–7
- Anderson B 2010 Preemption, precaution, preparedness: anticipatory action and future geographies *Progress in Human Geography* 34 777–98
- Anderson B and McFarlane C eds 2011 Assemblage and geography *Area* 43 124–64
- Anderson B, Kearnes M, McFarlane C and Swanton D 2012 On assemblages and geography *Dialogues in Human Geography* 2 171–89
- Barad K 2007 *Meeting the universe halfway: quantum physics and the entanglement of matter and meaning* Duke University Press, Durham NC
- Barnes T J 2002 Performing economic geography: two men, two books, and a cast of thousands *Environment and Planning A* 34 487–512
- Barry A 2013 *Material politics: disputes along the pipeline* Blackwell, Oxford
- Bear C 2013 Assembling the sea: materiality, movement and regulatory practices in the Cardigan Bay scallop fishery *Cultural Geographies* 20 21–41
- Bennett J 2010 *Vibrant matter: a political ecology of things* Duke University Press, Durham NC
- Bingham N 1996 Object-ions: from technological determinism towards geographies of relations *Environment and Planning D: Society and Space* 14 635–57
- Braidotti R 2006 Posthuman, all too human: towards a new process ontology *Theory, Culture & Society* 23 197–208
- Callon M 1986 Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Briec Bay in Law J ed *Power, action and belief: a new sociology of knowledge?* Routledge, London 196–233
- Callon M 2002 Writing and (re)writing devices as tools for managing complexity in Law J and Mol A eds *Complexities: social studies of knowledge practices* Duke University Press, Durham NC 191–217
- Castree N 2002 False antitheses? Marxism, nature and actor-networks *Antipode* 34 111–46
- Collinge C 2006 Flat ontology and the deconstruction of scale: a response to Marston, Jones and Woodward *Transactions of the Institute of British Geographers* 31 244–51

- DeLanda M** 2006 *A new philosophy of society: assemblage theory and social complexity* Continuum, London
- Deleuze G** 2006 *Two regimes of madness* MIT Press, Cambridge MA
- Deleuze G and Guattari F** 1976 *Rhizome* Editions de Minuit, Paris
- Deleuze G and Guattari F** 1983 *Anti-Oedipus* University of Minnesota Press, Minneapolis MN
- Deleuze G and Guattari F** 1986 *Kafka: toward a minor literature* University of Minnesota Press, Minneapolis MN
- Deleuze G and Guattari F** 1987 *A thousand plateaus* University of Minnesota Press, Minneapolis MN
- Deleuze G and Parnet C** 1987 *Dialogues II* Columbia University Press, New York
- Dewsbury J-D** 2011 The Deleuze–Guattarian assemblage: plastic habits *Area* 43 148–53
- Dittmer J** 2014 Geopolitical assemblages and complexity *Progress in Human Geography* 38 385–401
- Doel M A** 1996 A hundred thousand lines of flight: a machinic introduction to the nomad thought and scrumpled geography of Gilles Deleuze and Félix Guattari *Environment and Planning D: Society and Space* 14 421–39
- Fariás I and Bender T** eds 2010 *Urban assemblages: how actor-network theory changes urban studies* Routledge, London
- Franklin S** 2013 *Biological relatives: IVF, stem cells, and the future of kinship* Duke University Press, Durham NC
- Gomart E and Hennion A** 1999 A sociology of attachment: music amateurs, drug users in **Law J and Hassard J** eds *Actor-Network Theory and after* Blackwell, Oxford 220–47
- Goodchild P** 1996 *Deleuze & Guattari: an introduction to the politics of desire* Sage, London
- Graham S** ed 2010 *Disrupted cities: when infrastructure fails* Routledge, London
- Haraway D** 1991 *Simians, cyborgs and women: the reinvention of nature* Routledge, London
- Harman G** 2007 Networks and assemblages: the rebirth of things in Latour and DeLanda Working Paper (roundtable.kein.org/sites/newtable.kein.org/files/Latour%2520and%2520DeLanda%25202.doc) Accessed 15 December 2015
- Harman G** 2009 *Prince of networks: Bruno Latour and metaphysics* re.Press, Melbourne
- Harrison C and Popke J** 2011 'Because you got to have heat': the networked assemblage of energy poverty in eastern North Carolina *Annals of the Association of American Geographers* 101 949–61
- Hennion A** 2013 Von einer soziologie der mediation zu einer pragmatik der attachements rückblick auf einen soziologischen parcours innerhalb der *CSI Zeitschrift für Medien- und Kulturforschung* 2013 13–38
- Hinchliffe S, Kearnes M B, Degen M and Whatmore S** 2005 Urban wild things: a cosmopolitical experiment *Environment and Planning D: Society and Space* 23 643–58
- Iliadis A** 2013 Interview with Bruno Latour (<http://figure-ground.org/interview-with-bruno-latour/>) Accessed 14 December 2015
- Knopp L** 2004 Ontologies of place, placelessness, and movement: queer quests for identity and their impacts on contemporary geographic thought *Gender, Place & Culture* 11 121–34
- de Laet M and Mol A** 2000 The Zimbabwe bush pump: mechanics of a fluid technology *Social Studies of Science* 30 225–63
- Latour B** 1987 *Science in action: how to follow scientists and engineers through society* Open University Press, Milton Keynes
- Latour B** 1999a Fractures/fractures: from the concept of network to the concept of attachment *RES: Anthropology and Aesthetics* 20–31
- Latour B** 1999b On recalling ANT in **Law J and Hassard J** eds *Actor-network theory and after* Blackwell, Oxford 15–25
- Latour B** 2004 How to talk about the body? The normative dimension of Science Studies *Body & Society* 10 205–29
- Latour B** 2005 *Reassembling the social* Oxford University Press, Oxford
- Latour B and Hermant E** 1998 *Paris: ville invisible* La Découverte, Paris
- Latour B and Hermant E** 2006 Paris: invisible city (<http://www.bruno-latour.fr/node/343>) Accessed 15 December 2015
- Laurier E and Philo C** 1999 X-morphising: review essay of Bruno Latour's *Aramis, or the Love of Technology* *Environment and Planning A* 31 1047–71
- Law J** 2004 *After method: mess in social science research* Routledge, London
- Law J** 2009 Actor-network theory and material semiotics in **Turner B** ed *The new Blackwell companion to social theory* Blackwell, Oxford 141–58
- Law J and Hassard J** eds 1999 *Actor-network theory and after* Blackwell, Oxford
- Law J and Mol A** 2001 Situating technoscience: an inquiry into spatialities *Environment and Planning D: Society & Space* 19 609–21
- Legg S** 2009 Of scales, networks and assemblages: the League of Nations apparatus and the scalar sovereignty of the Government of India *Transactions of the Institute of British Geographers* 34 234–53
- Legg S** 2011 Assemblage/apparatus: using Deleuze and Foucault *Area* 43 128–33
- Li T M** 2007 Practices of assemblage and community forest management *Economy and Society* 36 263–93
- Li T M** 2014 What is land? Assembling a resource for global investment *Transactions of the Institute of British Geographers* 39 589–602
- Lorimer J** 2015 *Wildlife in the anthropocene: conservation after nature* University of Minnesota Press, Minneapolis MN
- Marcus G E and Saka E** 2006 *Assemblage Theory, Culture & Society* 23 101–6
- Massumi B** 1996 Becoming-Deleuzian *Environment and Planning D: Society and Space* 14 395–406
- Massumi B** 2002 *Parables for the virtual: movement, affect, sensation* Duke University Press, Durham NC
- McCormack D P** 2008 Engineering affective atmospheres on the moving geographies of the 1897 Andrée expedition *Cultural Geographies* 15 413–30
- McFarlane C** 2009 Translocal assemblages: space, power and social movements *Geoforum* 40 561–7
- McFarlane C** 2011a *Learning the city: knowledge and translocal assemblage* Wiley-Blackwell, Oxford
- McFarlane C** 2011b The city as assemblage: dwelling and urban space *Environment and Planning D: Society and Space* 29 649–71

- Militz E and Schurr C** 2015 Affective nationalism: banalities of belonging in Azerbaijan *Political Geography* early online <http://dx.doi.org/10.1016/j.polgeo.2015.11.002>
- Mol A** 2002 *The body multiple: ontology in medical practice* Duke University Press, Durham NC
- Mol A and Law J** 1994 Regions, networks and fluids: anaemia and social topology *Social Studies of Science* 24 641–71
- Müller M** 2015 Assembling power: assemblages, actor-networks and politics *Geography Compass* 9 27–41
- Murdoch J** 1998 The spaces of actor-network theory *Geoforum* 29 357–74
- Murdoch J** 2006 *Poststructuralist geography* Sage, London
- Ong A** 2007 Neoliberalism as a mobile technology *Transactions of the Institute of British Geographers* 32 3–8
- Ong A and Collier S J** 2005 *Global assemblages: technology, politics, and ethics as anthropological problems* Wiley-Blackwell, Oxford
- Parry B** 2015 A bull market? Devices of qualification and singularisation in the international marketing of US sperm in **Parry B, Greenhough B, Brown T and Dyck I** eds *Bodies across borders: the global circulation of body parts, medical tourists and professionals* Ashgate, Farnham 53–72
- Puar J K** 2005 Queer times, queer assemblages *Social Text* 23 121–39
- Robbins P and Marks B** 2010 Assemblage geographies in **Smith S J, Pain R, Marston S and Jones III J P** eds *The Sage handbook of social geographies* Sage, London 176–95
- Roberts S M** 2014 Development capital: USAID and the rise of development contractors *Annals of the Association of American Geographers* 104 1030–51
- Ross A** 2005 Desire in **Parr A** ed *The Deleuze dictionary* Edinburgh University Press, Edinburgh 65–7
- Schurr C and Fredrich B** 2015 Serving the transnational surrogate market as a development strategy? in **Coles A, Grey L and Momsen J** eds *A handbook of gender and development* Routledge, London 236–43
- Smith R G** 2003 World city actor-networks *Progress in Human Geography* 27 25–44
- Spar D** 2006 *The baby business: how money, science, and politics derive the commerce of conception* Harvard Business School Press, Cambridge MA
- Star S L** 1999 The ethnography of infrastructure *American Behavioral Scientist* 43 377–91
- Thien D** 2005 After or beyond feeling? A consideration of affect and emotion in geography *Area* 37 450–4
- Thompson C** 2005 *Making parents: the ontological choreography of reproductive technologies* MIT Press, Cambridge MA
- Thrift N** 2000 Afterwords *Environment and Planning D: Society and Space* 18 213–55
- Thrift N** 2008 *Non-representational theory: space, politics, affect* Routledge, London
- Tolia-Kelly D P** 2006 Affect – an ethnocentric encounter? Exploring the ‘universalist’ imperative of emotional/affective geographies *Area* 38 213–7
- Whatmore S** 2002 *Hybrid geographies: natures, cultures, spaces* Sage, London